

REMARKS

The Final Office Action of April 28, 2006, has been received and reviewed.

Claims 1-7, 9-14, and 18-24 are currently pending and under consideration in the above-referenced application. Of these, claims 1-4, 6, 13, 18, 19, 21, 23, and 24 stand rejected, but the Office has indicated that claims 5, 14, 20, and 22 are directed to allowable subject matter, and claims 7 and 9-12 have been allowed.

Reconsideration of the above-referenced application is respectfully solicited.

Rejections under 35 U.S.C. § 102

Claims 1-4, 6, 13, 18, 19, 21, 23 and 24 stand rejected under 35 U.S.C. § 102(b).

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single reference which qualifies as prior art under 35 U.S.C. § 102. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Morita or Mandelman

Claims 1-4, 6, 13, 18, 19, 21, 23, and 24 are rejected under 35 U.S.C. § 102(b) for being drawn to subject matter that is allegedly anticipated by the description of U.S. Patent 5,506,168 to Morita et al. (hereinafter “Morita”) or U.S. Patent 5,521,422 to Mandelman et al. (hereinafter “Mandelman”).

Independent claim 1 recites a structure that includes at least one shallow trench isolation structure with a substantially flat surface and an integral ledge that contacts an area of the active surface of a semiconductor substrate of the structure located adjacent to a trench within which the shallow trench isolation structure is at least partially located. There is no discernable boundary between the integral ledge and a remainder of the shallow trench isolation structure.

Independent claim 13 is drawn to an intermediate semiconductor device structure that includes a semiconductor substrate with at least one trench formed therein, and a trench isolation structure within the at least one trench. The trench isolation structure also extends laterally over at least one

at least one trench corner and contacts a portion of the active surface of the semiconductor substrate adjacent to a trench corner.

Independent claim 18 is directed to a precursor to a semiconductor device structure. The precursor of independent claim 18 includes a semiconductor substrate, at least one trench formed in the semiconductor substrate, and a buffer film layer over an active surface of the semiconductor substrate. In addition, the at least one shallow trench isolation structure includes at least one integral ledge that extends laterally outward from the at least one trench so as to contact an area of the active surface adjacent the at least one trench.

It is respectfully submitted that neither Mandelman nor Morita anticipates each and every element of any of claims 1-4, 6, 13, 18, 19, 21, 23, or 24.

Morita describes a structure that includes substrate 1 with a trench formed therein, a silicon oxide film 11 lining the active surface of the substrate 1 and the surfaces of the trench, and a silicon nitride film 37 within the trench.

It has been asserted that the silicon oxide film 11 is a part of the same structure as the trench isolation structure 3(37). Office Action of April 28, 2006, page 2. Notably, the silicon dioxide film 11 and the silicon nitride 37 insulation film 3 of the structure described in Morita are fabricated separately from one another and from different materials. As such, the silicon dioxide film 11 prevents the silicon nitride 37 insulation film 3 from contacting a surface of the substrate 1 of the structure of Morita.

Each of independent claims 1, 13, and 18, by its plain language, requires that a trench isolation structure contact an active surface of a semiconductor substrate. As Morita lacks any express or inherent description that the insulation film 3(37) contacts the active surface of a substrate 1, Morita does not anticipate each and every element of any of independent claims 1, 13, or 18.

Moreover, assuming, for the sake of argument, that the silicon dioxide film 11 could be considered to be part of a shallow trench isolation structure, as the silicon dioxide film 11 contacts an area of an active surface of the substrate 1, it would be analogous to the ledge recited in independent claims 1 and 18. Nonetheless, it is evident from the disclosure of Morita that, since the silicon

since the silicon dioxide film 11 and silicon nitride 37 insulation film 3 of Morita are fabricated separately from one another, they are not integral. Therefore, even if the silicon dioxide film 11 could be considered to form a ledge of a shallow trench isolation structure, it could not be considered to form an “integral” ledge, as would be required for Morita to expressly or inherently describe, or anticipate, each and every element of independent claim 1 and independent claim 18.

Further, with respect to independent claim 1, assuming again, *arguendo*, that the silicon dioxide film 11 and the silicon nitride 37 insulation film 3 of Morita could both be considered to form a shallow trench isolation structure, there is a discernable boundary between these films 11 and 3. As such, Morita does not expressly or inherently describe, or anticipate, at least one shallow trench isolation structure “with no discernable boundary between [an] integral ledge” (*e.g.*, and a remainder of the at least one shallow trench isolation structure . . .”

Therefore, under 35 U.S.C. § 102(b), the subject matter to which each of independent claims 1, 13, and 18 is directed is allowable over the subject matter disclosed in Morita.

Claims 2-4 and 6 are each allowable, among other reasons, for depending directly or indirectly from independent claim 1, which is allowable.

Each of claims 19, 21, 23, and 24 is allowable, among other reasons, for depending directly or indirectly from independent claim 18, which is allowable.

Mandelman describes and illustrates a precursor to a semiconductor device structure that includes a semiconductor substrate 10 with trenches 16 formed therein. *Mandelman*, col. 5, lines 3-23, and FIG. 4c. The trenches 16 of the semiconductor substrate 10 are lined with a thermal oxide 34, as are areas of the active surface of the semiconductor substrate 10 that are located adjacent to the trenches 16. *Id.* STI structures 18 fill the remaining space within the trenches, and include corner dielectrics 22c that extend laterally over regions of the active surface of the semiconductor substrate 10 that are located adjacent to the trenches 16. *Id.* The STI structures 18 and their corner dielectrics 22c contact the thermal oxide 34 that lines the trenches 16 and regions of the active surface of the semiconductor substrate 10 that are adjacent to the trenches 16. *Id.* The thermal oxide 34 prevents

to the trenches 16. *Id.* The thermal oxide 34 prevents the STI structures 18a and their corner dielectrics 22c from contacting any portion of the active surface of the semiconductor substrate 10. *Id.*

It has been asserted that Mandelman “discloses in the process step between the intermediate products of figures of 4a and 4b [a] trench isolation structure contacting the surface of the active surface area adjacent the trench . . .” Office Action of April 28, 2006, page 2. A closer look at FIGs. 4a-4c of Mandelman will reveal, however, that the active surface of the silicon substrate 10 is covered by the thermal oxide layer 34, thus preventing the contact of corner dielectric 22c of STI structure 18 from contacting the active surface of the substrate 10.

Pad oxide 11 of the structure described in Mandelman may not properly be categorized as a part of either the silicon substrate 10 or an STI structure 18. This is because Mandelman clearly describes the pad oxide 11 as being formed on the silicon substrate 10 before the trench 16 is formed in the silicon substrate 10 and, thus, before STI structure 18 is introduced into the trench. Col. 3, lines 55-65. As FIG. 4c of Mandelman shows that the pad oxide 11 remains in place between the active surface of the silicon substrate 10 and the STI structure 18 once STI structure 18 is patterned from insulator 18a, it is clear that pad oxide 11 prevents any portion of structure 18 that extends over the active surface of the silicon substrate 10 from contacting the active surface. Therefore, Mandelman does not expressly or inherently describe a structure in which a portion of a trench isolation structure that extends over the active surface of a semiconductor substrate contacts the active surface.

Furthermore, assuming, *arguendo*, that the pad oxide 11 and the STI structure 18 of Mandelman were actually parts of the same structure, it is respectfully submitted that the manner in which they are fabricated prevents the pad oxide 11 from being “integral” with the STI structure 18, as would be necessary for Mandelman to anticipate each and every element of independent claim 1. Additionally, the manner in which the pad oxide 11 and STI structure 18 of Mandelman are formed results in a discernable boundary between these elements, contrary to the requirement of independent claim 1 that there be no discernable boundary between a ledge of a shallow trench isolation structure and the remainder of the shallow trench isolation structure.

As such, Mandelman does not anticipate each and every element of any of independent claims 1, 13, or 18, as would be required to maintain the 35 U.S.C. § 102(b) rejections of these claims.

Claims 2-4 and 6 are each allowable, among other reasons, for depending directly or indirectly from independent claim 1, which is allowable.

Each of claims 19, 21, 23, and 24 is allowable, among other reasons, for depending directly or indirectly from independent claim 18, which is allowable.

Withdrawal of the 35 U.S.C. § 102(b) rejections of claims 1-4, 6, 13, 18, 19, 21, 23, and 24 is respectfully solicited, as is the allowance of each of these claims.

Allowable Subject Matter

The allowance of claims 7 and 9-12 and the indication that claims 5, 14, 20, and 22 are directed to allowable subject matter are gratefully acknowledged. None of claims 5, 14, 20, or 22 has been amended to independent form, as the claims from which they depend are believed to be separately allowable.

CONCLUSION

It is respectfully submitted that each of claims 1-7, 9-14, and 18-24 is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Brick G. Power", with a long horizontal flourish extending to the right.

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